

1 1. An edge detector for detecting an edge of an object, said edge detector  
2 comprising:

3  
4 a first optical fiber, with a receiving end and a transmitting end, adapted  
5 to receive laser light at the receiving end and create a light beam at the  
6 transmitting end;

7  
8 a second optical fiber, with a receiving end and a transmitting end,  
9 positioned such that the receiving end of the second optical fiber  
10 receives the light beam and transmits light to the transmitting end of  
11 the second optical fiber; and

12  
13 an optical power detector optically coupled to the transmitting end of  
14 the second optical fiber, the optical power detector having an output  
15 indicative of the optical power of the light transmitted through the  
16 second optical fiber;

17  
18 wherein the edge of the object is detected when the object at least  
19 partially obstructs the light beam, causing a change in the output of the optical  
20 power detector.

21  
22 2. The edge detector of claim 1, further comprising a laser light source  
23 coupled to the receiving end of the first optical fiber.

24  
25 3. The edge detector of claim 1, further comprising:

1 a mirror positioned to reflect said light beam;  
 2 wherein the receiving end of the second optical fiber receives the light  
 3 beam after it has been reflected by the mirror.

4  
 5 4. The edge detector of claim 1, wherein at least one of the first and second  
 6 optical fibers is a single mode optical fiber.

7  
 8 5. The edge detector of claim 1, wherein the light beam is less than 10  
 9 microns in diameter.

10  
 11 6. The edge detector of claim 1, wherein said first and second optical fibers  
 12 are held in opposition by a retainer.

13  
 14 7. The edge detector of claim 6, wherein said retainer further comprises:  
 15 a frame; and  
 16 at least one retaining block attached to the frame,  
 17 wherein the first and second fibers are constrained to lie in one or more  
 18 channels formed between the frame and the at least one retaining block.

19  
 20 8. A device for positioning an edge of an object, said device comprising:

21  
 22 a laser light source;

23  
 24 a first optical fiber, with a receiving end and a transmitting end, optically  
 25 coupled to the laser light source at the receiving end and creating a



12. A device as in claim 11, wherein at least one of the lower and upper thresholds is proportional to a maximum power which is the optical power at the detector when no part of the object obstructs the light beam.

13. A device as in claim 12, wherein the maximum power is predetermined by a calibration.

14. A device as in claim 12, wherein the maximum power is measured periodically.

15. A device as in claim 11, wherein at least one of the lower and upper thresholds is dependent upon a minimum power, which is the optical power at the detector when the light beam is completely interrupted by the object, and upon a maximum power, which is the optical power at the detector when no part of the object obstructs the light beam.

16. A device as in claim 8, wherein the object is supported by the positioning stage.

17. A device as in claim 8, wherein the retainer is coupled to the positioning stage.

18. An edge detector for detecting an edge of an object, said edge detector comprising:

an optical coupler, having at least three ports adapted to receive laser light at a first port of the at least three ports;

an optical fiber optically coupled to and receiving laser light from a second port of the at least three ports at a first end and creating a light beam at a second end;

a mirror separated from the second end of the optical fiber by a gap and positioned to receive the laser light beam and reflect it back to the second end of the optical fiber;

a retainer for holding the optical fiber and the mirror; and

an optical power meter optically coupled to a third port of the at least three ports, the optical power meter having an output indicative of the optical power of the light transmitted through the second optical fiber;

wherein the edge of the object is detected when an object in the gap at least partially obstructs the light beam, causing a change in the output of the optical power meter.

19. The edge detector of claim 18, further comprising a laser light source optically coupled to the first port of the at least three ports.

20. The edge detector of claim 18, wherein the optical fiber is a single mode optical fiber.

21. The edge detector of claim 18, further comprising:

a positioning stage for adjusting the relative positions of the object and the light beam; and

a controller operably coupled to the positioning stage and responsive to the optical power signal, the controller being configured to cause the positioning stage to position the object at a predetermined position relative to the light beam.

22. A device as in claim 21, wherein the controller is manually operated.

23. A device as in claim 21, wherein the controller is an automatic controller.

24. A device as in claim 21, wherein the position of the object relative to the light beam is adjusted so that the optical power signal is greater than a lower threshold and less than an upper threshold.

25. A device as in claim 24, wherein at least one of the lower and upper thresholds is proportional to a maximum power which is the optical power at the detector when no part of the object obstructs the light beam.

1 26. A device as in claim 18, wherein the optical coupler is an optical circulator  
2 with at least three ports.

3  
4 27. A system for detecting an edge of an object, said system comprising:

5 an edge detector, said edge detector comprising:

6 a first optical fiber, with a receiving end and a transmitting end,  
7 adapted to receive laser light at the receiving end and create a  
8 light beam at the transmitting end;

9  
10 a second optical fiber, with a receiving end and a transmitting  
11 end, positioned such that the receiving end of the second  
12 optical fiber receives the light beam and transmits light to the  
13 transmitting end of the second optical fiber; and

14  
15 an optical power detector optically coupled to the transmitting  
16 end of the second optical fiber, the optical power detector having  
17 an output indicative of the optical power of the light transmitted  
18 through the second optical fiber;

19  
20 an object positioning stage for adjusting the position of the object in a  
21 first direction; and

22  
23 a detector positioning stage for adjusting the position the edge detector  
24 in a second direction;

wherein the edge of the object is detected when the object at least partially obstructs the light beam, causing a change in the output of the optical power detector.

28. A system as in claim 27, further comprising a controller operably coupled to the object positioning stage and the detector positioning stage and responsive to the optical power signal, the controller being configured to cause the object positioning stage and the detector positioning stage to position the edge of the object at a predetermined position relative to the light beam.

29. A system as in claim 27, further comprising an object holder mounted on the object positioning stage for holding one or more objects.

30. A system as in claim 27, further comprising a detector holder mounted on the detector positioning stage for holding the edge detector.

31. A system as in claim 30, further comprising an edge detector calibration fiducial attached to the detector holder at a known location for use in the calibration of the edge detector.

32. A system as in claim 27, wherein the first direction is substantially perpendicular to the second direction.



33. A system as in claim 27, wherein the one of the object positioning stage and the detector positioning stage includes a linear servo-motor.

34. A method positioning an edge of an object, said method comprising:

generating a light beam by passing light from a laser light source through a first optical fiber;

receiving the light beam from the first optical fiber through a second optical fiber;

detecting the optical power of the received light; and

positioning the edge of the object within the light beam such that the optical power of the received light is greater than a lower threshold and less than an upper threshold.

35. A method as in claim 34, wherein at least one of the lower and upper thresholds is proportional to a maximum power which is the optical power at the detector when no part of the object obstructs the light beam.

36. A method as in claim 34, wherein the maximum power is predetermined by a calibration.



1 predetermined distance until the optical power is greater than the lower  
2 threshold and less than the upper threshold.

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